COMMISSION OF THE EUROPEAN COMMUNITIES

FIFTH REPORT OF THE MINES SAFETY AND HEALTH COMMISSION

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CONTENTS

INTRODUCTION

The Fifth Report of the Mines Safety and Health Commission for 1967 follows the same concise pattern as the Fourth Report and the preceding Summary Report accompanying the Third Report.

The Report proper includes:

1. a summary of the activities of the Mines Safety and Health Commission and its Working Parties;
2. accident statistics for the period from 1958 to 1967 with comments on their trend;
3. an examination of the manner in which the Mines Safety and Health Commission's recommendations were implemented up to 1.1.1968, and a summary of the regulations issued during 1967.

The detailed tables of accident statistics, the detailed report on the implementation of recommendations, the list of reports drafted by the Working Party on Inflammable Dusts, the Working Parties' terms of reference, the Sixth Report on Rescue Arrangements for the period from 1965 to 1966, and the up-to-date list of members of the Mines Safety and Health Commission and its Working Parties will be found in a separate annex.

The present report also includes documentation on the stabilisation of ventilation in the event of underground fires.

SECTION I

ACTIVITIES OF THE MINES SAFETY AND HEALTH COMMISSION

The Mines Safety and Health Commission met twice in 1967 and the Restricted Committee three times. There were 20 meetings of the Working Parties on technical aspects and of their various expert committees, one of the Working Party on health, five of the Working Parties on human factors, and two of the panel of judges on the competition for improved mine safety appliances.

The end of 1967 was marked by the transfer of the powers of Mr. COPPÉ, Chairman of the Mines Safety and Health Commission, former Vice-President of the High Authority, to Mr. LEVI SANDRI, Vice-President of the Commission of the European Communities. This transfer of powers took place in connection with the merger of the Executives of the European Communities, during the meeting of the Mines Safety and Health Commission on 15 December, 1967.

A further feature of 1967 was the revision of the terms of reference and set-up of the Working Parties. The terms of reference were simplified, their aims delimited and where necessary their time-limits set. They were also divided into two parts, the first relating to topics capable of leading fairly quickly to practical conclusions, the second to work requiring preliminary spadework before being submitted to the Working Parties. This preliminary work will be carried out by the Secretariat for the purpose of rationalisation and with a view to easing the burden of work falling on experts confronted with increasingly difficult tasks in their countries. The Secretariat will also occupy itself with questions calling for periodic review in order to keep up with technological advances.

The Mines Safety and Health Commission has also recommended that the number of expert committees be limited and that they should not be set up without having obtained its permission beforehand.

As a result of this reorganisation, the Working Parties on Rescue Arrangements and on Mine Fires and Underground Combustion were merged into a single Working Party, their permanent terms of reference being the study of accidents within their scope and the lessons to be drawn from them.

The Working Party on Health, which continues the activities of the former Working Party on Medical Problems of a Safety Policy, began its activities in 1967.

In connection with the activities of the Working Party on Psychological Factors affecting Safety, a restricted meeting was held of the officials responsible for conducting safety campaigns, its aim being to take stock of knowledge gained in this field with a view to the organisation of such campaigns on a Community scale.

The Mines Safety and Health Commission having intimated that the results of its work should be more rapidly disseminated among interested parties by means of interim reports, the first such reports on the activities of the Working Parties on Combustible Dusts and Electrification were submitted to the meetings of the Restricted Committee and the Mines Safety and Health Commission held in December 1967. The Working Party on Rescue Arrangements and Fires and Underground Combustion also submitted a report drafted by the Expert Committee on Ventilation.

The Working Party on Effects of Working Time on Safety of Work, especially in Difficult or Unhealthy Conditions, met to study the last item of its terms of reference, relating to damp workings.

Finally, the Panel of Judges on the Competition for Improved Mine Safety Appliances completed its work.

The Commission's Secretariat also assisted in teach-ins for trade-union officials at Douai and Haltern am See.

As in the previous Report and the Summary Report of the Third Report, Section I consists of a very brief account of the original purpose of the activities of each Working Party, the progress made in 1967, the conclusions reached, and problems still outstanding.

I. TECHNICAL PROBLEMS

A. Rescue Arrangements, Fires and Underground Combustion

The two Working Parties on Rescue Arrangements and on Mine Fire and Underground Combustion, which had already met on common ground and shared several members, were merged by a decision of the Mines Safety and Health Commission with a view to rationalisation and economy.

Mr. Heller, who was appointed by the Mines Safety and Health Commission at the end of 1966 to succeed Mr. Latten, is the Chairman of the two merged Working Parties which first met in their new form on 10 November 1967. The merged Working Party's terms of reference as reviewed and adopted by the Commission on 24-25 April 1967, will be found in the Annex to this Report.

Matters specifically relating to rescue work will be solely dealt with by the rescue station leaders who are members of the new merged Working Party.

The Working Party held three plenary meetings and three meetings on rescue work.

1. Shaft fires

Previous activities were referred to on page 9 of the Fourth Report. After the fire experiment carried out with the High Authority's financial support in an abandoned pit at Dorstfeld, studies were continued on fire extinction by spraying, by assembling documentary information on studies and research, especially with small-scale models, and the results of cold-water spraying carries out in Belgium.

After examining this material, the Committee investigated the possibility of performing tests with small-scale models for the better understanding of the way in which a shaft fire starts, particularly a fire which spreads along a shaft wall, and means of controlling it.

The Committee met twice. It recognised the scientific value of these tests with small-scale models, but thought they should be confirmed by means of actual scale tests which are costly and required much preparation. The Committee was therefore uncertain whether, at present, the tests deserved priority over other research work called for by the present situation in the coalmining industry. It noted that the risk of shaft fires being caused by air entering from older abandoned workings had in fact been reduced, and in this connection it stressed the importance of preventing the kind of shaft fire referred to in the Conference and in the Mines Safety and Health Commission Resolutions with special reference to the fireproof lining of new pits. Lastly, it specified which of its directives of 8 April 1960 on the control of shaft fires should be reviewed in the light of information gained from certain cold-spraying trials, especially the aeromotive power of the water discharge which should allow for the space occupied by the coalface supports.

The conclusions were approved by the Working Party and the Restricted Committee, but consideration of the question by the Mines Safety and Health Commission had to be postponed until 1968. After the Expert Committee has revised the directives of 8 April 1960, its work will have been completed.

2. Fire-resistant fluids

Under the Working Party's terms of reference, the experts on this Committee met four times for the purpose of:

- comparing results so as to avoid the same products being differently valuated by different testing stations. In this connection, a restricted meeting was held at the Institut National des Mines at Pâturages, to compare once again certain elements in the flammability test;
- where necessary, bringing the test criteria into line with technological progress.
- Within this context, the Expert Committee has drafted certain technological and health criteria with a view to the publication of a "Third Report on the specification and test conditions relating to fire-resistant power transmission fluids" (1).

The Working Party experienced some difficulty in applying these criteria and thought the requirements might be too strict and preclude the use of oils which, although not conforming to the specifications, were still less flammable than the mineral oils still in use. It therefore asked the Expert Committee to examine the advisability of linking the specifications relating to various fluids with their specific use, the amounts employed, and the fire risk inherent in machinery using these oils, with a view to relaxing the flammability criteria. The Mines Safety and Health Commission included this request in the terms of reference.

The Expert Committee studied this item and gave a negative reply, its view being that no products exist which, although not fulfilling the Mines Safety and Health Commission's requirements, were fire-resistant, had the same lubricating qualities as mineral oils, and did not involve any technical modifications to the installations.

It is therefore satisfactory to note that the Expert Committee's work and the know-how acquired through mine trials in this still comparatively unknown field, have attracted the attention of other industries such as forging and casting plants.

The Expert Committee then considered the question of certain fluids, known to be fire-resistant, but causing premature wear and tear of bearings whose life may thereby be reduced to 20% of the value reached with mineral oil.

In view of these difficulties, research work will be carried out in Germany in an attempt to adapt the present materials to the use of fire-resistant oils.

Lastly, the Commission decided (1) that the Secretariat, together with the Working Party on Rescue Arrangements, Fires and Underground Combustion, should keep track of the problem and, in due course, review the criteria and test methods with the possible help of the Expert Committee.

3. Foamed urethane seals

The Working Party was then led to consider the risks involved when stopping roadways with foamed urethane, i.e. spontaneous combustion, very rapid flame propagation, and static electricity.

It heard the results of trials, which were not subsidised by the Community, carried out at the Hasselt Centre de Coordination des Centrales de Sauvetage and at the Dortmund Versuchsgrubengesellschaft. Practical solutions appear to have been found. The Secretariat has been instructed to follow up this question and in due course to place it on the agenda.

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(1) Mines Safety and Health Commission Decision dated 26 April 1968.

4. Opening-up of stoppings of fire zones

The Working Party studied cases in which fire zones had been successfully opened up by means of various techniques. One fire zone in the Cevennes Colliery was opened up by the "pistoning" method in which the dangerous mixture was rapidly driven by an air blast into roadways from which workmen had been evacuated and spark sources removed. Fire zones in the Dortmund colliery area were opened up by the method of continuously driving out a gaseous mixture in an attempt to dilute it to a safe content.

5. Rescue by means of large boreholes

The Working Party considered the problems still involved in rescuing trapped miners by means of large boreholes not excavated from the surface as was the case at Lengede and Champagnoles, but from underground roadways. These boreholes have already been the subject of national research in Lorraine, Pas-de-Calais and the Ruhr. The Working Party concluded that the problems still outstanding could be settled by means of trials which should be on a Community level since very extensive and rarely used facilities would be needed, thus calling for an alignement of research and materials.

The Working Party drew up a list of trials to be carried out, specifying their object.

The Restricted Committee approved these proposals on 5 December 1967. Under Section 5 of its terms of reference, the Mines Safety and Health Commission will propose to the Commission of the European Communities that research be undertaken in this field (1).

6. Ventilation

The ventilation experts did not meet in 1967. As stated on page 11 of the Fourth Report, the conclusions drawn from the work they have been engaged on since 1961, were submitted in the form of a report entitled "Stabilisation of the ventilation of a mine in the event of fire", a documentary report dated September 1967 on Professor Budryk's theory, and a document on "Practical Conclusions on the Ventilation Stabilisation Theory".

The documentary report was submitted to the Working Party. It is a scientific account of which the main and most original feature is a mathematical demonstration of the validity of Budryk's basic formula as applied to the most complex cases occurring in modern mines. It also showed that it was possible to calculate mathematically the maximum possible disturbing effect of the fire, so that the areas threatened by inversion when a fire breaks out at a particular point can be determined beforehand. Lastly, it made clear that although the theory was based on Polish mines, it is equally applicable to the conditions prevailing in Community mines in all cases of fires at ascensionally-ventilated working points in gassy and non-gassy mines.

These studies are valuable inasmuch as they take a new look at the important question of mine ventilation, with particular reference to the unstable ventilation that may arise and is in fact an increasingly common occurrence with the present concentration of pits.

Having regard to the scientific nature of this report, the Mines Safety and Health Commission approved the Working Party's suggestion that it should be distributed to selected organisations, i.e. to Coal Boards for wider dissemination, and to all specialised international bodies.

The practical conclusions arrived at by the Expert Committee were first investigated by the Working Party in 1968 (2). After they have been studied by the Mines Safety and Health Commission, they will be passed on to the Governments for further action.

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(1) Mines Safety and Health Commission Decision dated 26 April 1968.

(2) The investigation was concluded on 24 April 1968.

As regards the implementation of research work in this field, the Mines Safety and Health Commission is of the opinion that the Working Party's terms of reference should be extended to cover all ventilation problems owing to their possible bearing on fires.

7. Rescue arrangements

The experts on Rescue Arrangements met twice. One meeting consisted of a visit to the Central Rescue Station at Lens where designers of breathing and detection apparatus exhibited their latest models and explained how they work. Mention should be made of respirators for a normal exposure of 3 hrs. or a short exposure of 45 mins., an explosimeter for rapid testing of the explosibility of gas mixtures and, lastly, a very simple colorimetric detector which responds to a low CO content.

The experts also studied, together with local specialists, problems still outstanding in rescue work by means of large boreholes.

B. Winding Ropes and Shaft Guides

The Working Party met twice and examined the following matters under its terms of reference:

1. Electro-magnetic testing of winding ropes

The Mines Safety and Health Commission's report on this matter gave rise to a number of positions being taken up. It was pointed out that the method described has certain advantages. Although the report drew attention to the limitations of the method, it by no means wished to give the impression that it could not be employed. It is now being regularly used by the Bochum Winding Rope Centre, which has also adopted it for types of winding ropes not used in mines.

2. Testing of couplings for circular strand and flattened-strand winding ropes

The Working Party examined ten cases of coupling accidents; their causes were defined and precautionary measures advocated. This study will be resumed and completed; the lessons to be learned are equally applicable elsewhere, e.g. to cableways and railways.

The Secretariat was instructed to compile a comparative table of regulations in this sphere.

3. Study of mechanical stresses on the shaft guides of winding ropes

The Working Party took note of an electrical dynamometer for measuring the mechanical stresses to which shaft guides are subject. It asked the Mines Safety and Health Commission for authority to deal with this question in connection with research work proposed by the Tremonia Experimental Mine.

Without prejudice to a possible decision to ask the Commission that further work on this subject might be undertaken, the Mines Safety and Health Commission authorised the Working Party to go to the Tremonia Experimental Mine te ascertain what facilities are available there.

C. Electrification

During two meetings, the Working Party continued to exchange notes on the deleterious effects of salt pastes and on the design of flexible cables for movable equipment (1).

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(1) See p. 13 of the Fourth Report.

It submitted to the Restricted Committee (1) an interim report on the deleterious effects on underground electrical installations of the moisture in salt pastes and salt powders used in dust suppression.

The study of the design of flexible cables for supplying voltages of up to 1,100 volts to such mobile equipment as coal-cutters and associated safety devices has almost been completed; the results are shown in the form of a table summarising the position at present and in the near future in the different Community countries.

In the meantime, restricted meetings have been held with the Secretariat with a view to preparing these documents.

In conclusion, following the investigations held into the accident at the "Unser Fritz" Mine ar Wanne-Eickel, the Working Party was given new terms of reference by the Mines Safety and Health Commission at its meeting of 15 December 1967, relating to the design of electric cables for voltages of up to 6,000 volts and devices used to protect such cables.

D. Combustible Dusts

The Working Party met once to examine the work of its two groups of rapporteurs (including representatives from the United Kingdom). The instructions given to this Working Party are the direct results of the conclusions drawn from the Luisenthal disaster. The first and most urgent part of the instructions was dealt with in reports adopted by the Restricted Committee on 5 December 1967 (1). These relate to dust barriers used for preventing the spread of dust explosions and include:

- An aide-mémoire for investigating officers on what useful accident data to collect for the study of dust explosions.

  This aide-mémoire is not an injunction and in no way affects national obligations regarding accident inquiries. It is to be considered as an aid to the work of the investigating officers, enabling them to assemble any useful accident-cause data and providing a guide to future studies and research.

- Comments on dust explosions in the Community and the United Kingdom since 1950. Only typical accidents have been selected; names have been omitted and the comments will be disseminated.

  In future, data on both dust and fire damp explosions will be recorded and disseminated, since firedamp is often found together with dust in the explosion process.

- Bibliographical studies on trials and research undertaken in Germany, France and Britain on the stopping of dust and firedamp-dust explosions.

- A joint programme of trials to be drawn up as soon as possible to fill the gaps discovered; its aim will be as follows:

  a) To make a thorough study of the phenomenon;

  b) to extend the efficiency of dust barriers to very large cross-sections, very slight explosions and very violent explosions;

  c) to bring dust barriers more into line with the kind of equipment at present used in collieries.

  It is hoped that this programme can be financed by the Commission of the European Communities.

- A system of joint reports on trials undertaken in the Community and Great Britain which would provide a basis for a uniform classification of the results of trials relating to dust and firedamp explosions.

The Restricted Committee (2) approved the Working Party's work on 5 December 1967, and decided to make it known in the appropriate quarters.

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(1) Approved by the Mines Safety and Health Commission on 26 April 1968.

(2) And the Mines Safety and Health Commission on 26 April 1968.

Work under the terms of reference will be continued, particularly the study of dust neutralisation, and account will be taken of the fact that, in most cases, firedamp is found together with combustible dusts when an explosion is triggered off and spread.

E. High Authority Competition for Improved Mine Safety Devices

This competition closed on 29 June 1967, so that the work may now be conveniently summarised. This work was continuously followed by the Mines Safety and Health Commission since the competition had been organised by the High Authority in 1957 in accordance with a recommendation by the Mines Safety Conference.

In 1962, the initial prizes amounting to 130,000 units of account were awarded for:

1) two pocket methanometers,

2) a portable firedamp detector,

3) three carbon monoxide recorders,

4) two fully-protective automatic safety devices.

The methanometers and firedamp detector could replace the miner's conventional flame safety lamp, at any rate for firedamp detection. The carbon monoxide recorders could give an early warning of a fire and follow its course with a view to overcoming it and making sure it is completely extinguished. Lastly the fully-protective automatic safety devices would enable miners to escape from a smoke-laden atmosphere due to a fire or explosion; this atmosphere may be contaminate with carbon monoxide or deficient in oxygen.

It should be noted that the miner's conventional flame safety lamp not only provides illumination but also a ready indication of the presence of firedamp or carbon monoxide, or atmospheres deficient in oxygen.

Although the competition had called for a flameless apparatus for detecting and giving warning, of a given oxygen deficiency, no suitable entry was submitted as it proved too difficult to dispense with the gas-detection flame. The closing date was therefore extended and a prize of 70,000 units of account offered. To encourage designers, the requirements of the first competition were relaxed as follows:

- the pocket format was no longer specified, although in shape, size and weight the apparatus was to embody the same characteristics as a portable electric lamp;
- the content setting off the alarm was raised from 15%-18% to 17%-19%;
- flame safety lamps were no longer barred, provided they comprised certain basic improvements over the conventional type of miner's lamp.

But the apparatus was still required to fulfil strict requirements as to accuracy (± 1%), maximum response time of 10 secs., insensitivity to disturbing factors, and the robust design needed to cope with the severe underground conditions.

Despite this stringency, 19 devices were submitted to the Panel on 8 October 1964, 7 being of the flame and 12 of the flameless type.

The measuring principles on which these devices operate are not new. The flameless type is based on physico-chemical principles (the thermal effect of an exothermic reaction with combustible vapours), electro-chemical principles (battery) or purely physical principles (oxygen paramagnetism). The safety principles of the flame-type devices are the length or brightness of the flame. Firedamp hazard is assessed and indicated by electromagnetic or electronic relays.

Considerable difficulties had to be overcome to apply principles to such a small-sized device. This fact, together with the large number of devices submitted for the Panel's consideration, gives a good idea of the value of the 1957 competition as an incentive to designers and as a means of increasing knowledge in this sphere.

The devices were checked in laboratories of the following Community research stations:

- the Prüfstelle für Grubenbewetterung, Bochum,
- the Forschungsstelle für Grubenbewetterung, Essen-Kray,
- the CERCHAR, Verneuil, France,
- the Institut National des Mines, Pâturages, Belgium,
- the Staatsmijnen Proefstation, Treebeek, Netherlands.

These laboratory tests, which were prepared and supervised by groups of rapporteurs appointed by the Panel, were carried out in stages corresponding to the difficulty of the checking required and the amount of equipment needed, some 15,000 measurements being called for.

During these trials numerous entries were rejected by the Panel, so that by September 1965, the closing date, only two variants of a flame-type apparatus and four flameless ones (including two embodiments of the same prototype) remained in the running.

These remaining entries were then subjected to six-month carrying tests underground at selected mines in order to test, in particular, their performance and robustness. But prolonged investigations and Inspectorate approval were needed before they could be used underground. Unfortunately, the certification conditions regarding flameproof properties and intrinsic safety has not yet been standardised throughout the Community, and this has held up and complicated Inspectorate approval. Underground testing of the devices in the Ruhr and Lorraine coalfields was not begun until the end of 1966. One nore flameless device was eliminated from the competition during these tests.

The Panel met on 29 June 1967, and decided to make the following awards to the designers of the three remaining devices:

1st prize of 40,000 units of account to

Bergbau-Forschung GmbH
Physikalische Abteilung
Essen-Kray

2nd prize of 15,000 units of account to

Auergesellschaft GmbH, Berlin

An award of 10,000 units of account to

Institut National des Mines, Pâturages

The Bergbau-Forschung device is already suitable for use in mines, although its 2,960 g weight should be reduced. Its safety principle is based on oxygen paramagnetism.

The Auer device weighs 1,460 g, but needs certain modifications before it can be used in a mine. Its safety principle is based on the amount of heat, in proportion to the atmospheric oxygen content, which is released by the combustion of cyclohexane vapour and measured by a Wheatstone bridge. This principle might enable both oxygen deficiency and firedamp to be detected by the same apparatus.

Lastly, the lamp designed by the Institut National des Mines is a benzine lamp without illuminating power. The brilliance of the flame, depending on the O_2 percentage, actuates a photoelectric cell which controls at a distance the ignition or extinction of the wearer's cap lamp via a short-wave transmitter. It is the same weight as the ordinary benzine lamp (1,850 g) and is very safe for use in a firedamp atmosphere. It can also be used as a methanometer. It needs some modifications before it can be used in mines.

F. Study of Accidents

Only one accident (at the Panissière mine on 2 March 1967) was notified to the Mines Safety and Health Commission in 1967 and was dealt with in an interim report. This Commission also examined the final reports on four other accidents which occurred in previous years, viz.:

a) Accident at the Panissière Colliery, Houillères du Bassin des Cévennes 2.3.1967. Sudden outburst of CO_2, 5 killed.

Pending the final conclusions reached at the enquiry, the main circumstances can be summarised as follows:

The sudden outburst occurred in a coalface in a thin seam during a coal-getting shift preceded by shatter blasting. This blasting replaced the expansion holes which had caused drilling difficulties owing to extensive coal production. At the scene of the accident, the men were still in the expansion hole area.

This was an outburst of gas mainly consisting of CO_2.

b) Accident at the Mont-Cenis Colliery, Herne-Solingen, 22.7.1965, 9 killed, firedamp explosion.

The firedamp explosion occurred while a shaft fire was being isolated by stopping. The accident was investigated by the Working Party on Mine Fires and Underground Combustion, the findings being as follows:

1. Pit Fires.

1.1. Any attempt to deal with a pit fire is a race against time. The fatal outcome at the Mont-Cenis Colliery was due tot the rapid and unexpected extension of the fire which spread more quickly than stopping operations could be carried out.

1.2. The essential conditions for effective fire-fighting are early detection of a pit fire and rapid provision of air-tight stoppings. Consequently, the Working Party on Rescue Arrangements, Fires and Underground Combustion should pay particular attention to technological advances in these fields.

1.3. The proper appraisal of a fire at the initial stage, its effect on mining operations, and the selection and use of appropriate fire-fighting facilities call for such great experience that, even for the smallest and apparently harmless fire, the officials in charge should enlist the aid of the specialist services (rescue stations) which exist in all Community countries (as the Mont-Cenis officials did in good time).

1.4. The rules and regulations governing the prevention and control of pit fires, as laid down by the mining authorities of the Community and the United Kingdom, should be set out synoptically, discussed by the Working Party, and presented in the form of a recommendation after it has utilised experience gained in this field.

2. Rescue Arrangements.

2.1. Thanks and praises are due to the mine rescue teams who, under the most difficult conditions, spared no pains to rescue miners trapped in the explosion area.

2.2. In the case of Mont-Cenis, rescue teams from neighbouring collieries had to be called in under the mutual aid plan organised by the mining authorities. This again revealed the need for an aid plan which would cover any eventuality. Priority should be given to the Working Party's efforts to draft a supranational aid plan, with particular reference to the special rescue equipment owned by the various rescue services, as well as to the experts engaged therein.

2.3. The rules and regulations governing rescue work, as set out by the mining authorities of the Community and the United Kingdom, and the medical aid system, should be aligned by the Mines Safety and Health Commission's Secretariat, after which the findings should be utilised by the Working Party.

2.4. At the time of the accident, the fireproof garments worn by members of the Rescue Team were found unsatisfactory under the prevailing conditions. The Working Party should study the requirements expected of fireproof clothing in the various Community countries as well as the general specifications.

2.5. Past experience, including that gained in the Mont-Cenis accident, shows how essential it is for the rescue service management to have its own office in the administrative buildings, where it can work undisturbed. During the actual rescue operations, all persons outside, whatever their rank, should only be informed of the progress made via special liaison officers attached to the rescue service management, and not by the head of the rescue station himself.

The Mines Safety and Health Commission approved these findings and directed the Working Party on Rescue Arrangements, Mine Fires and Underground Combustion to study paragraphs 1.2., 1.4., 2.2., 2.3. and 2.4., as well as the problem of indicating and closing dangerous areas, for instance those where a firedamp explosion hazard exists.

c) Accident at the Rossenray Pit, 16.2.1966, 16 killed, firedamp explosion.

The accident occurred in a new pit where the seam-working method is employed, i. e. in which little preliminary work is needed on the stonedrifts, the roadways being tunnelled beforehand along the strike of the seam and in the seam itself.

The firedamp was ignited by a short-circuit spark from a junctionbox opened under voltage and on which an electrician had been working. This firedamp came from old workings, situated near the damaged roadway from which they were sealed off by glass-wool stoppings. The roadway was strongly ventilated, but ventilation conditions in the district were found to be unstable.

As a result of the accident, the following precautions were taken:

1) for better supervision of the ventilation conditions, a full-time ventilation engineer has been assigned to the Rossenray pit;

2) a list will be compiled of all walls and stoppings which will be periodically inspected to check their gas-tightness and measure their pressure conditions. The lists can always be consulted by the Mines Department;

3) the supports of roadways tunnelled by the continuous miner are to be reinforced by two clamp bolts for each pit prop secured to the walls and by one clamp bolt for each bar. To prevent the supports from collapsing, a bar is also to be fixed to the roof at 25 m intervals;

4) the brickwork walls prescribed by the Mines Department regulations to ensure the closure of underground workings where the ventilation is temporarily interrupted may only be replaced by Sillan cushion stoppings provided these are lined with gas-tight latex.

The accident also focused attention on the new problems arising out of the coal-winning method which are still being studied, i.e. latexlined Sillan cushions, suppression of the dust in strike roads entirely in the seam, the delimiting of areas tunnelled by this method, the possible need to revert to the method of coalwinning at several levels linked by staple shafts, and advance information on unstable ventilation conditions.

d) Accident at the Unser Fritz pit, 30.6.1966, 7 killed, dust explosion.

This dust explosion of weak intensity occurred in an intake near a loading point, during shotfiring for enlarging the roadway cross-section.

It is probable that no firedamp was involved. The dust was ignited by a short-circuit of a high-tension (5,000 volt) cable which was freely suspended and protected by half-tubes joined together and probably damaged by a previous shot.

The effect of the explosion was limited by the efficient working of inert dust stoppings.

The following findings were reached after a national enquiry:

1. After the explosion, no fire broke out except in the cable duct of blind shaft 872. Despite the high temperatures, the plastic ventilation lines only melted; other equipment made of synthetic material was deformed but did not burn. In this case, the Mines Regulations calling for fireproof materials gave good results and were confirmed.
2. During this accident, the only fire point was the cable duct of blind shaft 872 which was supported by wooden blocks. Although the Mines Regulations specify that cable ducts are to be supported by incombustible materials, the mine was authorised to waive this rule owing to the very high rock pressure. The accident proved the value of the Mines Regulations. Even with the high rock pressure, wooden supports should not be used in cable ducts and rooms.
3. Miners caught by the accident, who put on their filter-type self-rescuers immediately after the explosion, were not found to have any asphyxia symptoms. The 12 asphyxia cases found were due to the explosion blast that prevented the victims from using their filter-type self-rescuers, or from fitting them soon enough. In this connection, the accident confirms that, when a workman has his rescue equipment with him, this greatly increases his chance of survival in the event of a pit accident (explosion or fire).
4. The use of filter-type self-rescue undoubtedly prevented asphyxiation, but some workmen who wore the apparatus succumbed to burns in the buccal cavity through inhaling air resulting from the chemical decomposition of CO inside the self-rescuer, and also from chin and chest burns caused by contact with the extremely hot outer envelope of the apparatus. To prevent such burns in the future, new models have been produced in which the inhaled air is cooled (for example, by coolings fins). It is essential to introduce these improved models as soon as possible.
5. This accident should again focus attention on the most satisfactory method of installing underground electrical cable systems with emphasis on the protection of high-tension cables.

   The Mines Safety and Health Commission instructed the Working Party on Electrification to study the construction of underground electric cables of up to 5,000 volts and the materials for their protection.

e) Accident at Silverwood, Yorks., 3.2.1966, 10 killed, collission between trains.

A train carrying materials was following a man-riding train on a track dipping on average 12 mm/metre and in places 40 mm/metre. The driver lost control and jumped clear, his train running into the one ahead.

After examining the final report, the Mines Safety and Health Commission asked the Secretariat to draw up a synoptic table showing different countries' regulations governing track gradients, maximum loads for mine-car trains, and the training of drivers.

II - HUMAN FACTORS

A. Health

The Working Party responsible for continuing certain activities of the Working Party on Medical Problems of a Safety Policy will deal with the medical and technical aspects of health.

In order to draw up a programme of work, documents were assembled by the Secretariat in 1966 with the help of persons delegated by the Mines Safety and Health Commission and the High Authority Department. The definite programme was set out in a mandate adopted by the Mines Safety and Health Commission on 24 and 25 April 1967. In the first stage, this mandate only relates to technical questions.

This Working Party was set up with tripartite representation, like the Mines Safety and Health Commission. At present, it consists of experts and dust-suppression technologists; its constitution will be reviewed to include the study of medical problems.

The Working Party met once. It took note of its terms of reference, the chief of which is the drafting of a possible recommendation on measures for controlling, and general measures for reducing, the dustiness of underground workings; it is acknowledged that such measures have to some extent been effective.

It heard a report on the present state of progress of the High Authority's research work in this field.

It was decided that each delegation should supply the Secretariat with documentary material on dust control methods and try to grade these methods according to their effectiveness. The measuring methods, on which no agreement was reached, will not be discussed, but the measuring equipment and selectivity of the measurements will be mentioned. The Secretariat was instructed to assemble the data needed for working out a draft recommendation based on these documents.

B. Working Party on Effects of Working Time on Safety at Work, especially in difficult or unhealthy conditions

This group held two meetings, one plenary and one restricted.

In the former terms of reference stemming from the Safety Congress, priority was given to the question of hot and wet working points. This complex subject was dealt with in a report and recommendation on the "fixing of climatic limits" which was approved by the Mines Safety and Health Commission on 18 june 1963 (cf. Third Report, pages 403-410).

The terms of reference also included a study of working time spent in thin seams. It was decided at a meeting of the Mines Safety and Health Commission that, as fewer and fewer of these seams were being worked, they did not merit any particular attention.

The one outstanding item was hot working points. As atmospheric humidity had been considered during the study of hot working points, the Mines Safety and Health Commission decided to confine its attention to wet working points and drafted the following provisional terms of reference:

- examination of the number of hours worked in wet working points,
- determining in what cases a working point is to be considered wet and the precautions to be taken.

At the meeting of 5 July 1967, the Working Party members set forth the following conclusions which they submitted to the Mines Safety and Health Commission:

- the problem om wet working points is only sporadically encountered in Community mines;
- it is not an urgent problem;
- protective measures and working hours are usually laid down by the local authorities;
- in the absence of any objective criteria for determining the wetness of working points, it is a difficult matter to suggest what precautionary measures should be taken on a Community level;
- it is scarcely feasible to limit the terms of reference to safety questions without including health precautions, these being the chief factor to be taken into consideration;
- certain other environmental factors such as noise, lighting, etc. are more urgent.

After discussing these matters, the Working Party decided to advise the Mines Safety and Health Commission that the question of wet working points was not

an urgent one to be settled on a Community level and that if, nevertheless, it had to be examined, this would mean a fairly difficult investigation involving health questions, in which case the Commission should define new terms of reference.

Lack of time prevented the Restricted Committee and the Mines Safety and Health Commission from examining this question at their December 1967 meetings.

C. Psychological and Sociological Factors affecting Safety

The terms of reference of this Working Party related to:

- safety campaigns,
- a draft recommendation on the employment of foreign and young workers (the items still outstanding in the terms of reference).

A meeting of safety campaign officials employed in various Community coalfields was held at Luxemburg, for two days, they had an instructive exchange of views which resulted in a great deal of documentary material being assembled by the Secretariat.

The following conclusions may be drawn from these sessions. It is both useful and possible to organise safety campaigns at Community level so that all can profit from the same experiences and audio-visual material, provided such campaigns are actually organised according to mining zones where conditions are fairly similar. The campaigns could be organised simultaneously and cover the same specific topic. The main subject to be dealt with should relate to the causes of rockfalls and accidents associated with haulage and transport equipment, these together constituting the most frequent source of accidents (70%) in which the human factor plays a considerable part and which could therefore be reduced by such campaigns.

In view of these safety considerations, talks on the dissemination of information were resumed with trade union officials and a teach-in was organised at Douai on 10 April 1967 during which representatives of the Mines Safety and Health Commission's Secretariat gave a statement on the result of its work. The Secretariat also gave its assistance during the trade union teach-ins held at Haltern on 30 June 1967.

SECTION II

STATISTICS

This section follows the same pattern as that of the Summary Report attached to the Third Report and that of the Fourth Report.

The statistical tables of serious and fatal accidents in the various Community coalfields in 1967 will be found in the Annex. As usual, the figures are given by causes of accidents for the different coalfields and countries, and for the Community.

Tables A and B, below show the figures by causes of accidents in Community countries from 1958 to 1967. Table C gives the same data for the period from 1960 to 1967 for group accidents, i.e. those involving more than five serious or fatal casualties. Graphs 1-6, following this section, give the same data for all accidents, including group accidents, thus bringing out a certain statistical trend or at least certain variations over the years. It is recalled that a Working Party on Joint Statistics of Accidents in Coalmines is being set up to examine how far these statistics are comparable and what can be done to improve them in this respect. In addition, in view of the comparative shortness of the period covered, it does not as yet seem possible to establish a statistical trend from these tables. This being so, the remarks which follow are offered with certain reservations, as in the two previous Reports.

Examination of the number of fatalities below ground per million man-hours (Table B and Graph 1) shows that, from 1966 to 1967, the fatality rate fell by 14,7%. The actual number of fatalities fell from 347 to 269, i.e. 28%, but the number of man-hours was down from 698m to 587m, i.e. 16%. This fatality rate is well below the level for 1961-1966 mentioned in the Fourth Report and seems to be following the same downward trend as was noted in the Summary Report. It should be observed that, in 1967, no fatalities were reported as a result of group accidents (actually, two accidents occurred with five fatalities each), whereas in 1965 and in 1966 the figures were 41 and 21 fatalities respectively.

As for previous years, it can be seen that, in 1967, accidents listed under causes I to V (Table A and Graph 1) were responsible for 92% of all fatalities, viz. cause I (rockfalls), 42%; causes II and III (haulage and transport and movement of personnel), 37%; causes IV and V (machinery, tools and falling objects), 13%.

Examination of the serious-injury rate per million man-hours (Table A and Graph 2) shows that, although it apparently fell in 1965 and 1966 while showing no more than the single standard deviation from the arithmetical mean, it was unchanged in 1966-1967. As in the years surveyed by the previous two Reports, the same five causes were responsible for the great bulk (97.2%) of the seriously injured, with the incidence about equally divided among cause I (rockfalls), 30%, causes II and III (haulage and transport and movement of personnel), 33%, and causes IV and V (machinery, tools and falling objects) also 33%.

As Graph 4 shows, rockfalls, though still the largest single factor, showed a decrease of 3% in 1967 as compared with 7% for 1965 and 1966 together; this annual drop of about 3% seems to be a regular feature. For transport (II and III) the rate also went down by 2.2% in 1967 as against 3.2% for 1965 and 1966, while that for the handling of equipment and for falling objects (IV and V) rose 6%, thus confirming the generally upward trend in the rate of such accidents, noted in the previous two Reports, where it was observed that this increase might be associated with the concentration and mechanisation drive which has been a feature of the last decade.

Lastly, as in the previous two Reports, the number of fatalities and serious injuries per number of tons extracted will be found in Table D, these figures being purely for guidance as was stated previously.

The Recapitulatory Table and Tables 5 and 6 below show that Community production fell 10% and the number of man-hours by 16%, while productivity went up by 8%.

The fatality rate per million tons extracted fell below 1.5 (in 1958 it exceeded 3), and the serious-injuries rate went down by a third in the same period.

A. Comparative Table of

numbers of persons incapacitated by underground accidents

for eight weeks or longer

years 1958-67

per '000,000 man-hours

CAUSE (1958-1962)	Germany (North Rhine/Westphalia and Saar)					Belgium					France (excl. Provence)					Italy					Netherlands					Community				
	1958	1959	1960	1961	1962	1958	1959	1960	1961	1962	1958	1959	1960	1961	1962	1958	1959	1960	1961	1962	1958	1959	1960	1961	1962	1958	1959	1960	1961	1962
1) Falls of ground	4.843	4.779	4.886	4.797	4.682	5.911	4.294	4.324	4.071	4.439	5.027	4.665	4.774	4.416	4.222	1.355	1.378	1.808	-	0.792	1.326	1.464	1.305	1.829	2.238	4.846	4.490	4.571	4.434	4.387
2) Haulage and transport	2.550	2.569	2.445	2.458	2.501	4.132	2.979	2.709	2.770	3.331	1.980	1.695	1.920	2.106	2.196	1.335	0.984	1.205	0.676	1.847	1.511	1.562	1.898	1.924	2.590	2.602	2.347	2.310	2.371	2.521
3) Movement of personnel	2.497	2.463	2.348	2.512	2.608	1.354	0.998	1.008	1.062	1.136	1.505	1.118	2.873	2.334	2.458	0.668	0.394	1.005	1.578	1.056	0.324	0.386	0.187	0.514	0.580	2.003	1.823	2.185	2.185	2.282
4) Machinery, handling of tools and supports	0.767	0.914	0.920	0.867	1.046	2.804	2.085	2.386	2.097	2.461	0.914	1.022	1.621	2.523	2.991	1.169	0.984	0.603	0.902	1.584	0.617	0.402	0.780	0.915	1.015	1.098	1.064	1.264	1.423	1.712
5) Falling objects	2.537	2.719	2.738	2.945	3.077	0.414	0.371	0.354	0.301	0.445	1.890	2.187	1.893	2.292	2.073	1.169	1.968	1.808	2.029	2.375	0.401	0.515	0.492	0.819	0.642	1.962	2.161	2.105	2.353	2.375
6) Explosives	0.015	0.011	0.010	0.009	0.008	0.027	0.007	0.032	0.018	-	0.043	0.051	0.031	0.017	0.051	0.167	-	-	0.225	-	-	-	-	-	-	0.023	0.020	0.017	0.012	0.018
7) Explosions of firedamp or coal dust	0.011	0.016	-	0.002	0.123	-	-	-	-	-	0.047	0.088	-	-	0.004	-	-	-	-	-	-	-	-	-	-	0.017	0.030	0.010	0.001	0.071
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	0.011	-	-	-	-	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	-	-	-	-
9) Underground combustion and fires	-	-	0.003	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	0.001	-
10) Inrushes of water	0.004	-	-	-	-	-	-	-	-	0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	-	-	-	0.001
11) Electricity	0.010	0.014	0.012	0.014	0.006	0.011	-	0.016	0.018	0.010	0.014	-	0.004	0.029	0.004	-	-	-	-	-	-	-	-	-	0.021	0.010	0.008	0.010	0.018	0.007
12) Other causes	0.487	0.522	0.457	0.503	0.488	0.260	0.255	0.260	0.301	0.331	2.956	2.768	0.793	0.362	0.240	0.334	0.591	0.603	0.451	-	0.262	0.161	0.390	0.210	0.497	0.985	1.012	0.513	0.428	0.404
TOTAL	13.721	14.007	13.819	14.109	14.539	14.924	10.989	11.089	10.638	12.161	14.380	13.594	13.909	14.079	14.239	6.197	6.299	7.032	5.861	7.654	4.441	4.490	5.051	6.212	7.583	13.551	12.954	12.986	13.227	13.781
(1963-1967)	1963	1964	1965	1966	1967	1963	1964	1965	1966	1967	1963	1964	1965	1966	1967	1963	1964	1965	1966	1967	1963	1964	1965	1966	1967	1963	1964	1965	1966	1967
1) Falls of ground	4.663	4.894	4.732	4.721	4.524	4.432	4.417	3.574	3.568	3.850	4.177	4.308	3.941	3.927	3.634	0.366	0.893	5.572	6.360	5.580	1.742	2.017	1.923	1.688	2.466	4.337	4.509	4.215	4.186	4.060
2) Haulage and transport	2.433	2.385	2.411	2.067	1.913	3.565	3.419	2.866	3.269	2.960	2.364	2.278	2.153	1.858	1.918	1.465	1.787	-	0.707	0.797	1.826	1.952	2.808	2.621	1.866	2.520	2.346	2.416	2.173	2.037
3) Movement of personnel	2.646	2.744	3.032	2.852	2.974	1.066	0.961	0.771	0.936	0.903	2.368	2.383	2.087	2.239	2.174	0.732	1.787	-	0.707	1.594	0.630	0.472	0.774	0.605	0.766	2.261	2.326	2.364	2.320	2.354
4) Machinery, handling of tools and supports	1.213	1.242	1.234	1.244	1.124	2.414	2.310	2.126	2.146	2.265	3.096	3.042	2.272	2.639	2.773	1.465	3.127	7.164	7.067	13.552	1.050	1.094	1.282	2.066	0.833	1.818	1.848	1.773	1.815	1.790
5) Falling objects	3.038	3.242	3.344	3.272	3.642	0.547	0.397	0.292	0.349	0.459	2.278	2.074	1.839	1.785	2.114	3.296	3.574	0.796	-	6.377	0.630	0.923	0.862	0.958	0.866	2.406	2.442	2.415	2.362	2.638
6) Explosives	0.006	0.006	0.005	0.005	0.017	0.019	0.018	-	0.013	0.056	0.009	0.013	0.037	0.010	0.011	0.366	-	-	-	-	-	0.021	-	-	-	0.010	0.011	0.013	0.007	0.019
7) Explosions of firedamp or coal dust	0.010	-	0.014	0.013	-	-	0.009	0.031	-	-	-	-	-	0.029	-	-	-	-	-	-	-	-	-	-	-	0.006	0.001	0.011	0.016	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	0.005	-	0.003	-	-	-	0.013	-	-	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	0.002	0.001	0.003
9) Underground combustion and fires	-	-	-	-	-	-	-	0.021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	-	-
10) Inrushes of water	0.004	-	-	-	-	-	-	-	-	-	-	0.018	-	0.005	-	-	-	-	-	-	-	-	-	-	-	0.002	0.003	-	0.001	-
11) Electricity	0.012	0.009	0.002	0.010	0.006	0.009	-	0.010	0.013	-	0.014	0.009	0.014	-	0.005	-	-	-	-	-	-	0.021	-	-	-	0.012	0.008	0.006	0.007	0.005
12) Other causes	0.473	0.477	0.354	0.414	0.396	0.198	0.268	0.333	0.362	0.278	0.354	0.227	0.174	0.200	0.185	-	-	1.592	3.360	3.189	0.147	0.129	0.088	0.353	0.700	0.390	0.364	0.289	0.354	0.337
TOTAL	14.499	14.999	15.133	14.598	14.599	12.250	11.799	10.024	10.669	10.771	14.660	14.347	13.017	12.692	12.819	7.690	11.168	15.124	18.201	31.089	6.025	6.629	7.737	8.291	7.497	13.781	13.861	13.506	13.242	13.246

accidents resulting in death within eight weeks

years 1958-67

per '000,000 man-hours

CAUSE (1958-1962)	Germany (North Rhine/Westphalia and Saar)					Belgium					France (excl. Provence)					Italy					Netherlands					Community				
	1958	1959	1960	1961	1962	1958	1959	1960	1961	1962	1958	1959	1960	1961	1962	1958	1959	1960	1961	1962	1958	1959	1960	1961	1962	1958	1959	1960	1961	1962
1) Falls of ground	0.268	0.290	0.263	0.216	0.280	0.223	0.213	0.299	0.266	0.246	0.235	0.192	0.186	0.219	0.167	0.167	-	0.201	0.225	-	0.262	0.064	0.034	0.114	0.062	0.253	0.242	0.235	0.217	0.234
2) Haulage and transport	0.179	0.169	0.182	0.196	0.149	0.101	0.124	0.157	0.168	0.142	0.115	0.085	0.082	0.122	0.077	-	0.197	-	-	-	0.077	0.145	0.067	0.095	0.062	0.147	0.141	0.146	0.168	0.124
3) Movement of personnel	0.094	0.097	0.070	0.086	0.059	0.011	0.027	0.008	0.035	0.010	0.007	0.018	0.027	0.008	0.043	-	-	-	-	-	-	-	-	-	-	0.057	0.063	0.047	0.056	0.045
4) Machinery, handling of tools and supports	0.010	0.027	0.012	0.027	0.037	0.005	0.014	0.016	0.027	0.047	0.018	0.040	0.016	0.008	0.030	-	-	-	-	-	0.015	0.016	-	-	0.041	0.011	0.028	0.012	0.021	0.037
5) Falling objects	0.065	0.041	0.039	0.065	0.094	0.016	-	0.008	-	0.010	0.025	0.007	0.004	0.017	0.030	-	0.197	-	-	-	-	0.016	-	-	-	0.045	0.027	0.024	0.041	0.062
6) Explosives	0.009	0.003	0.003	-	0.004	0.011	0.014	-	-	-	-	0.026	-	-	-	0.501	-	-	-	-	-	-	-	-	-	0.009	0.010	0.002	-	0.002
7) Explosions of firedamp or coal dust	0.011	0.012	-	-	0.660	-	-	0.016	-	-	0.115	0.121	-	-	0.004	-	-	-	-	-	-	-	-	-	-	0.032	0.036	0.002	-	0.375
8) Sudden outbursts of firedamp suffocation by natural gases	0.005	0.003	0.002	0.004	0.002	0.016	0.014	-	-	0.047	0.043	0.026	0.019	0.004	-	0.167	-	-	-	-	-	-	-	-	-	0.016	0.010	0.006	0.003	0.007
9) Underground combustion and fires	-	0.003	-	0.002	-	-	0.007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	0.001	-
10) Inrushes of water	-	0.003	0.002	-	-	0.011	-	-	0.044	0.047	-	-	-	0.004	-	-	-	-	-	-	-	-	-	-	-	0.002	0.002	0.001	0.006	0.005
11) Electricity	0.022	0.008	0.002	0.005	0.010	0.021	-	0.024	-	-	-	0.011	0.012	-	0.009	-	-	-	-	-	-	-	-	0.019	-	0.016	0.007	0.007	0.004	0.008
12) Other causes	0.025	0.025	0.036	0.049	0.049	0.005	-	0.008	0.009	0.019	0.036	0.029	0.008	-	0.009	-	-	-	-	-	-	-	0.017	-	-	0.023	0.021	0.024	0.029	0.032
TOTAL	0.687	0.680	0.611	0.651	1.344	0.420	0.413	0.536	0.549	0.568	0.594	0.555	0.354	0.382	0.369	0.835	0.394	0.201	0.225	-	0.355	0.241	0.119	0.229	0.166	0.610	0.590	0.507	0.546	0.932
(1963-1967)	1963	1964	1965	1966	1967	1963	1964	1965	1966	1967	1963	1964	1965	1966	1967	1963	1964	1965	1966	1967	1963	1964	1965	1966	1967	1963	1964	1965	1966	1967
1) Falls of ground	0.260	0.200	0.184	0.197	0.206	0.264	0.222	0.239	0.324	0.264	0.120	0.127	0.164	0.214	0.159	0.366	-	-	-	-	0.084	0.043	0.044	0.050	0.100	0.217	0.175	0.177	0.208	0.192
2) Haulage and transport	0.178	0.200	0.191	0.175	0.150	0.245	0.166	0.166	0.187	0.180	0.121	0.141	0.052	0.126	0.088	-	-	-	-	0.797	0.105	0.172	0.177	0.126	-	0.167	0.178	0.149	0.160	0.128
3) Movement of personnel	0.089	0.071	0.070	0.094	0.076	0.057	0.028	0.011	0.025	-	0.009	0.009	0.042	0.024	0.016	-	-	-	-	-	-	-	-	-	-	0.060	0.045	0.051	0.060	0.044
4) Machinery, handling of tools and supports	0.019	0.028	0.025	0.030	0.020	-	0.018	0.052	0.025	0.028	0.009	0.036	0.009	0.015	0.016	-	-	-	-	0.797	-	-	0.022	-	0.067	0.013	0.030	0.024	0.023	0.024
5) Falling objects	0.072	0.054	0.058	0.048	0.063	0.019	0.018	-	-	-	0.009	0.018	0.019	0.015	0.011	-	-	-	-	-	-	0.043	-	-	-	0.046	0.037	0.037	0.030	0.036
6) Explosives	-	0.002	-	-	-	-	-	-	-	-	0.005	0.005	0.009	0.005	0.005	-	-	-	-	-	-	-	-	-	-	0.001	0.002	0.002	0.001	0.002
7) Explosions of firedamp or coal dust	0.002	0.002	0.019	0.056	-	-	-	0.011	-	-	-	-	0.155	-	-	-	-	-	-	-	-	-	-	-	-	0.001	0.001	0.053	0.030	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	0.002	0.002	0.007	-	-	0.041	0.013	-	0.019	0.009	-	0.005	0.027	-	-	-	-	-	-	-	-	-	-	0.005	0.002	0.006	0.004	0.012
9) Underground combustion and fires	0.006	0.009	0.005	-	-	-	-	0.011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	0.005	0.005	0	-
10) Inrushes of water	0.004	-	-	-	-	0.019	-	-	-	-	-	-	0.005	-	0.005	-	-	-	-	-	-	-	-	-	-	0.005	-	0.001	0	0.002
11) Electricity	0.002	0.004	0.005	-	0.003	0.009	0.009	0.011	-	0.014	0.024	-	-	0.010	-	-	-	-	-	-	-	-	-	-	-	0.008	0.003	0.004	0.003	0.004
12) Other causes	0.025	0.017	0.023	0.027	0.017	0.028	0.009	-	0.013	0.042	0.014	0.014	-	0.005	0.005	-	-	-	-	-	-	-	-	-	-	0.021	0.014	0.013	0.017	0.015
TOTAL	0.657	0.587	0.582	0.629	0.542	0.641	0.471	0.542	0.587	0.528	0.330	0.359	0.455	0.419	0.332	0.366	-	-	-	1.594	0.189	0.257	0.243	0.176	0.167	0.547	0.492	0.522	0.536	0.457

C. Comparative Table of underground group accidents (see (c) below)
years 1960-67

1960–1963 — Germany (N. Rhine/Westph.+ Saar)

CAUSE (1960-1963)	1960 N	1960 a	1960 b	1961 N	1961 a	1961 b	1962 N	1962 a	1962 b	1963 N	1963 a	1963 b
1) Falls of ground	2	2	10	-	-	-	1	1	6	-	-	-
2) Haulage and transport	-	-	-	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	3	62	338	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	2	2	10	-	-	-	4	63	344	-	-	-

1960–1963 — Belgium

CAUSE (1960-1963)	1960 N	1960 a	1960 b	1961 N	1961 a	1961 b	1962 N	1962 a	1962 b	1963 N	1963 a	1963 b
1) Falls of ground	-	-	-	-	-	-	1	2	6	-	-	-
2) Haulage and transport	-	-	-	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-		-		1	2	6	-	-	-

1960–1963 — France (excl. Provence)

CAUSE (1960-1963)	1960 N	1960 a	1960 b	1961 N	1961 a	1961 b	1962 N	1962 a	1962 b	1963 N	1963 a	1963 b
1) Falls of ground	-	-	-	1	-	7	1	-	6	-	-	-
2) Haulage and transport	-	-	-	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	1	-	7	1	-	6	-	-	-

1960–1963 — Italy

CAUSE (1960-1963)	1960 N	1960 a	1960 b	1961 N	1961 a	1961 b	1962 N	1962 a	1962 b	1963 N	1963 a	1963 b
1) Falls of ground	-	-	-	-	-	-	-	-	-	-	-	-
2) Haulage and transport	-	-	-	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	-	-	-	-	-

1960–1963 — Netherlands

CAUSE (1960-1963)	1960 N	1960 a	1960 b	1961 N	1961 a	1961 b	1962 N	1962 a	1962 b	1963 N	1963 a	1963 b
1) Falls of ground	-	-	-	-	-	-	-	-	-	-	-	-
2) Haulage and transport	-	-	-	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	-	-	-	-	-

1960–1963 — Community

CAUSE (1960-1963)	1960 N	1960 a	1960 b	1961 N	1961 a	1961 b	1962 N	1962 a	1962 b	1963 N	1963 a	1963 b
1) Falls of ground	2	2	10	1	-	7	3	3	18	-	-	-
2) Haulage and transport	-	-	-	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	3	62	338	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	2	2	10	1	-	7	6	65	356	-	-	-

1964–1967 — Germany (N. Rhine/Westph.+ Saar)

(1964-1967)	1964 N	1964 a	1964 b	1965 N	1965 a	1965 b	1966 N	1966 a	1966 b	1967 N	1967 a	1967 b
1) Falls of ground	-	-	-	-	-	-	-	-	-	-	-	-
2) Haulage and transport	2	5	14	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	1	4	8	2	5	21	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	2	5	14	1	4	8	2	5	21	-	-	-

1964–1967 — Belgium

(1964-1967)	1964 N	1964 a	1964 b	1965 N	1965 a	1965 b	1966 N	1966 a	1966 b	1967 N	1967 a	1967 b
1) Falls of ground	-	-	-	-	-	-	-	-	-	-	-	-
2) Haulage and transport	-	-	-	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-		-		-	-	-	-	-	-

1964–1967 — France (excl. Provence)

(1964-1967)	1964 N	1964 a	1964 b	1965 N	1965 a	1965 b	1966 N	1966 a	1966 b	1967 N	1967 a	1967 b
1) Falls of ground	-	-	-	-	-	-	-	-	-	-	-	-
2) Haulage and transport	-	-	-	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	2	-	33	1	6	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	2	-	33	1	6	-	-	-	-

1964–1967 — Italy

(1964-1967)	1964 N	1964 a	1964 b	1965 N	1965 a	1965 b	1966 N	1966 a	1966 b	1967 N	1967 a	1967 b
1) Falls of ground	-	-	-	-	-	-	-	-	-	-	-	-
2) Haulage and transport	-	-	-	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	-	-	-	-	-

1964–1967 — Netherlands

(1964-1967)	1964 N	1964 a	1964 b	1965 N	1965 a	1965 b	1966 N	1966 a	1966 b	1967 N	1967 a	1967 b
1) Falls of ground	-	-	-	-	-	-	-	-	-	-	-	-
2) Haulage and transport	-	-	-	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	-	-	-	-	-

1964–1967 — Community

(1964-1967)	1964 N	1964 a	1964 b	1965 N	1965 a	1965 b	1966 N	1966 a	1966 b	1967 N	1967 a	1967 b
1) Falls of ground	-	-	-	-	-	-	-	-	-	-	-	-
2) Haulage and transport	2	5	14	-	-	-	-	-	-	-	-	-
3) Movement of personnel	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling objects	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	3	4	41	3	11	21	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	2	5	14	3	4	41	3	11	21	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of type (a).
(N) Number of group accidents.

D. RECAPITULATION: COMMUNITY OVERALL

Year	Extraction (m. tons)	Underground o.m.s. (kg.)	In m. man-hours	Fatalities	Serious injuries (disablement for 8 weeks or over)	Fatalities per m. tons (1)	Serious injuries per m. tons (1)	Fatalities in m. man-hours	Serious injuries in m. man-hours
1958	252.278	1,634	1,260	770	17.074	3.052	67.68	0.610	13.551
1959	240.602	1,788	1,122	622	14.539	2.585	60.43	0.590	12.950
1960	239.967	1,958	1,037	526	13.459	2.192	56.09	0.507	12.986
1961	235.848	2,100	962	527	12.720	2.235	53.93	0.548	13.227
1962	233.233	2,229	901	840 (2) 541 (3)	12.418	3.602 (2) 2.320 (3)	53.24	0.932 (2) 0.600 (3)	13.781
1963	229.769	2,331	849	465	11.686	2.024	50.86	0.547	13.761
1964	235.007	2,395	841	411	11.726	1.749	49.89	0.493	13.860
1965	224.249	2,461	784	410	10.595	1.828	47.25	0.522	13.506
1966	210.189	2,611	698	374	9.247	1.779	43.99	0.536	13.242
1967	189.484	2,824	587	269	7.781	1.420	41.06	0.457	13.246
1968									

(1) Incl. net extraction, slurry and dust.

(2) Incl. Luisenthal explosion.

(3) Excl. Luisenthal explosion.

GRAPHS
OF FATAL AND SERIOUS CASUALTIES
IN COMMUNITY COALMINES

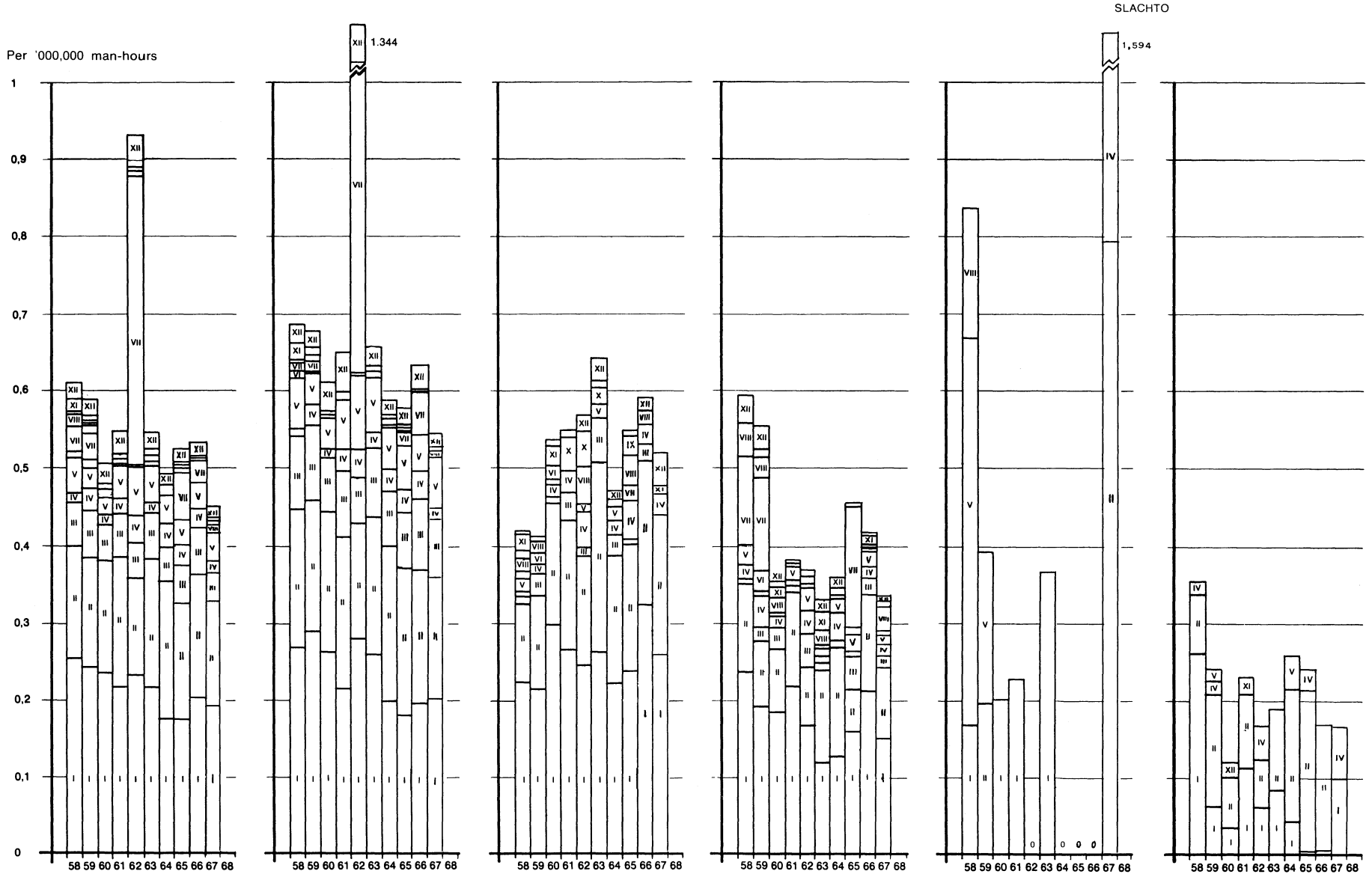
KEY

to Roman figures in Graphs

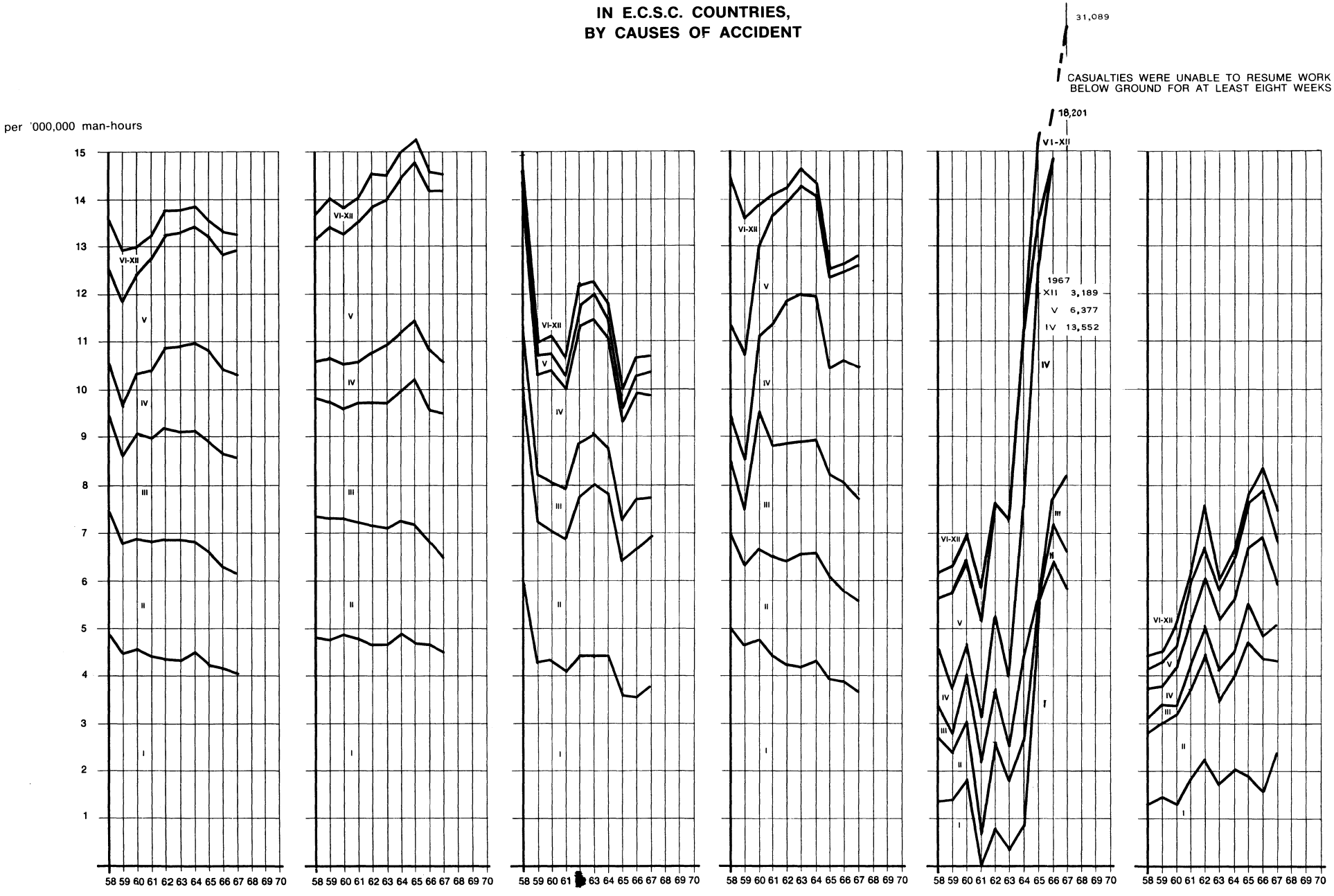
I	Falls of ground
II	Haulage and transport
III	Movement of personnel
IV	Machinery, handling of tools and supports
V	Falling objects
VI	Explosives
VII	Explosions of firedamp or coal dust
VIII	Sudden outbursts of firedamp, suffocation by natural gases
IX	Fires and underground combustion
X	Inrushes of water
XI	Electricity
XII	Other causes

FATALITIES BELOW GROUND IN E.C.S.C. COUNTRIES, BY CAUSES OF ACCIDENT

CASUALTIES DIED WITHIN EIGHT WEEKS



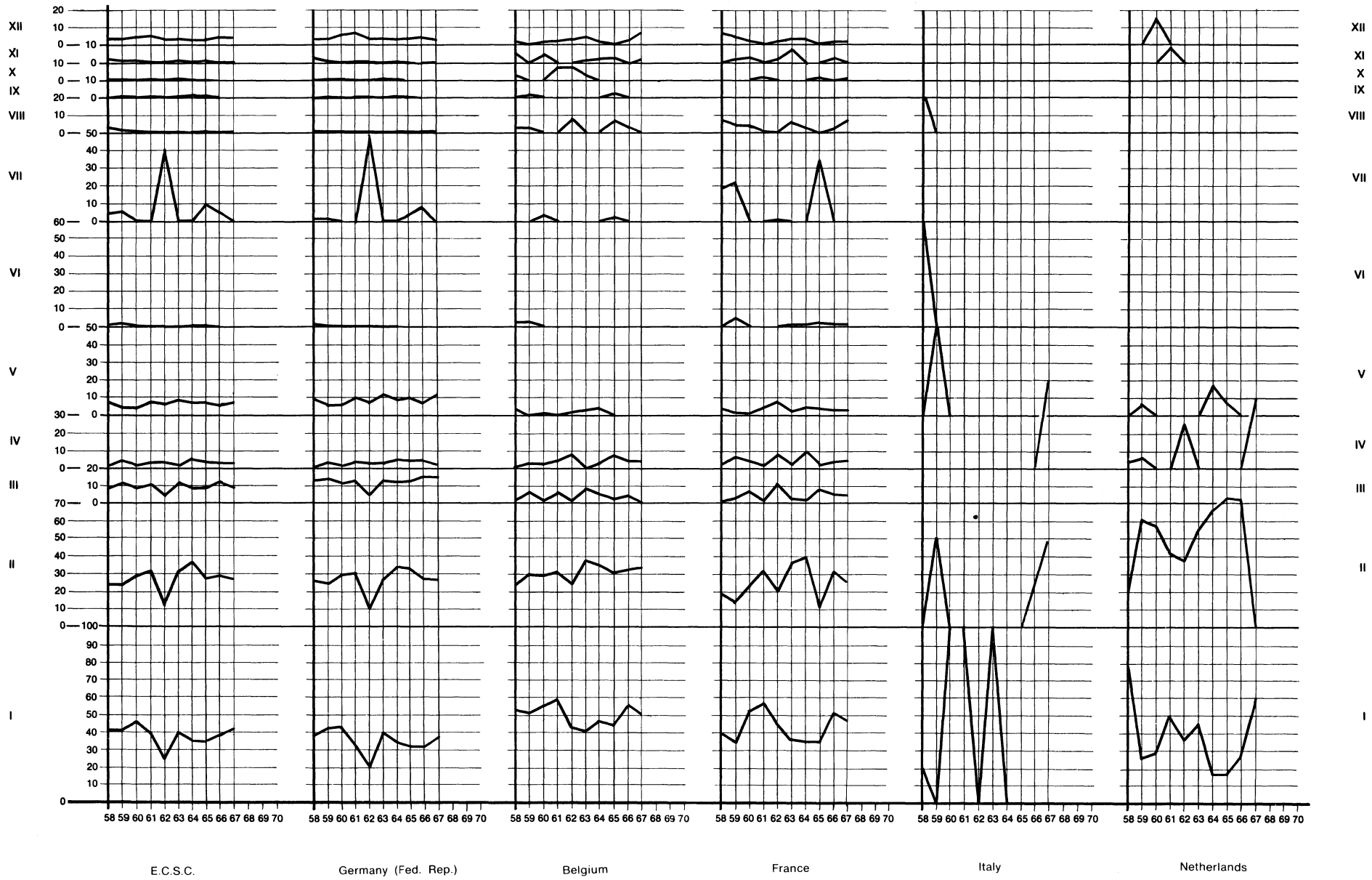
CASES OF SERIOUS INJURY BELOW GROUND IN E.C.S.C. COUNTRIES, BY CAUSES OF ACCIDENT



FATALITIES BELOW GROUND IN E.C.S.C. COUNTRIES, BY CAUSES OF ACCIDENT

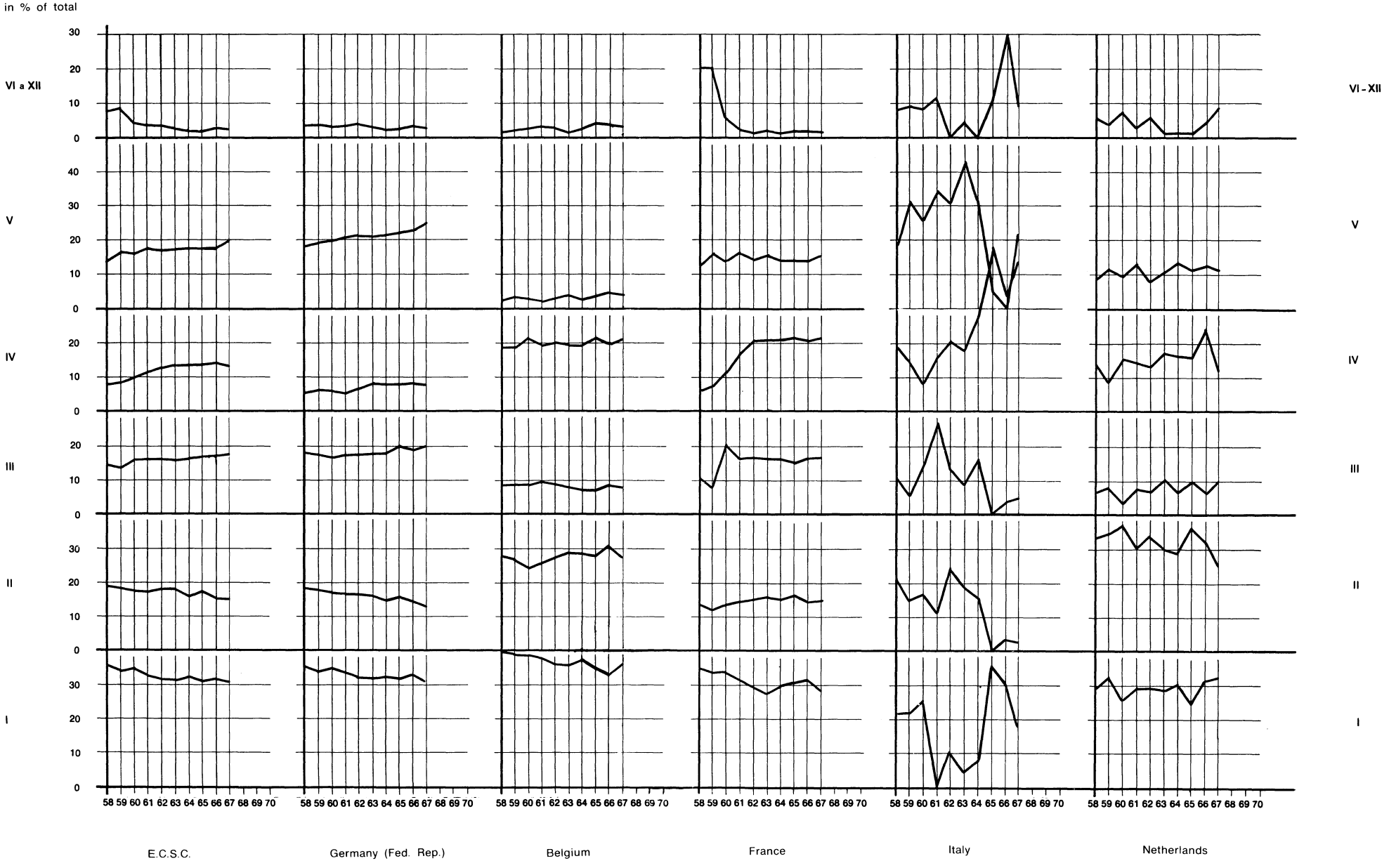
CASUALTIES DIED WITHIN EIGHT WEEKS

in % of total

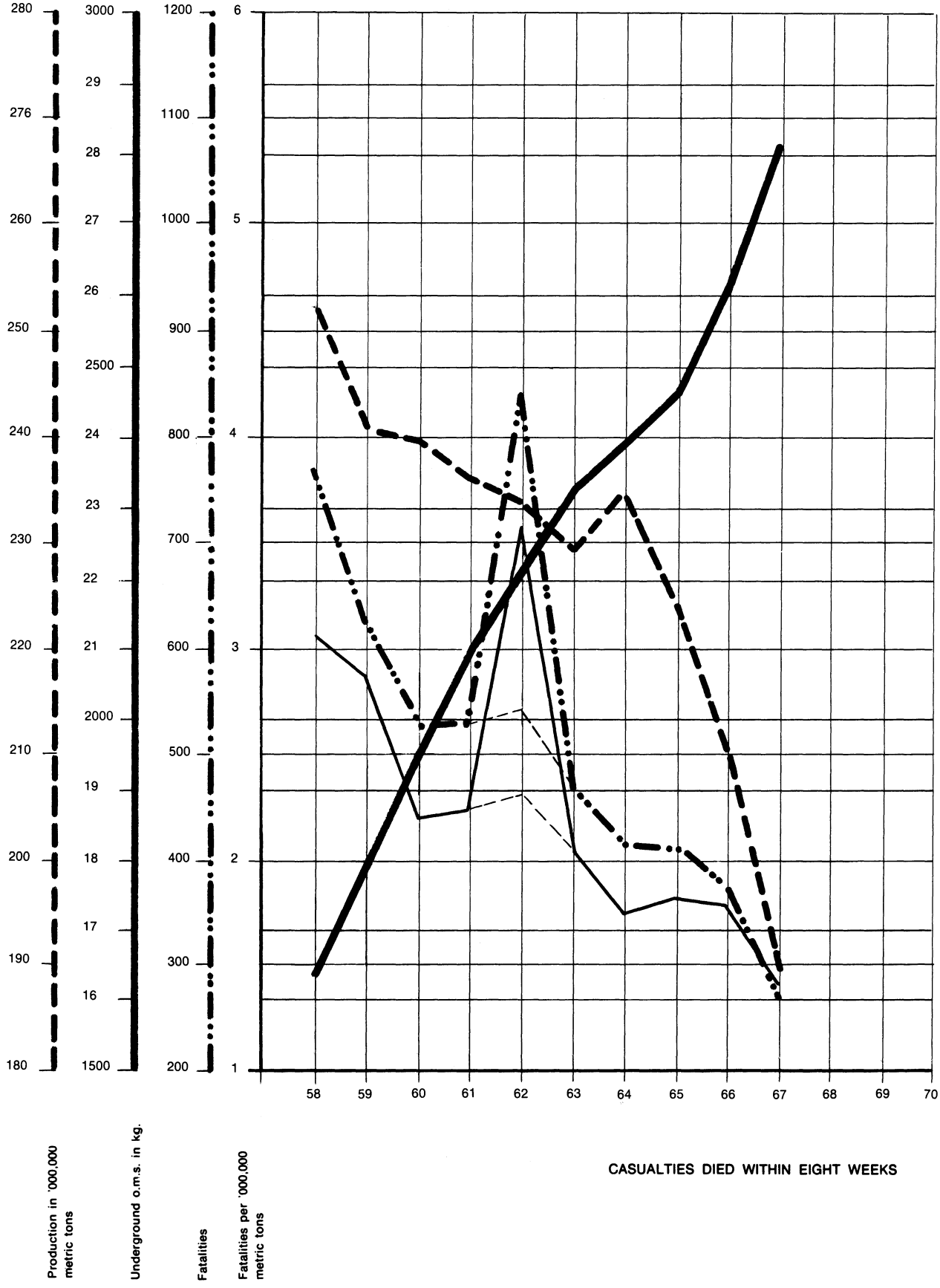


CASES OF SERIOUS INJURY BELOW GROUND IN E.C.S.C. COUNTRIES, BY CAUSES OF ACCIDENT

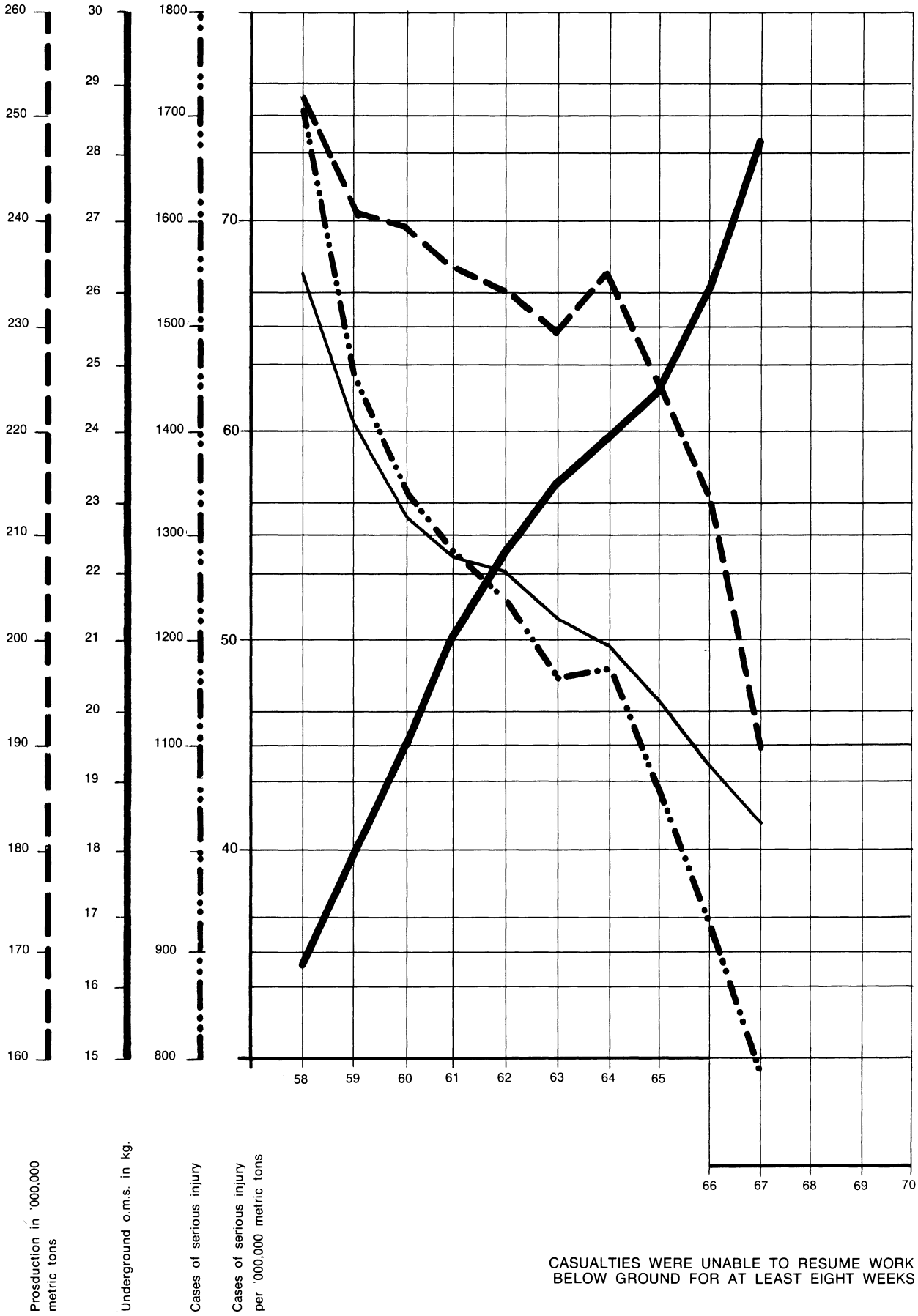
CASUALTIES WERE UNABLE TO RESUME WORK BELOW GROUND FOR AT LEAST EIGHT WEEKS



FATALITIES PER '000,000 METRIC TONS PRODUCED IN E.C.S.C. COUNTRIES



CASES OF SERIOUS INJURY PER '000,000 METRIC TONS PRODUCES IN E.C.S.C. COUNTRIES



CASUALTIES WERE UNABLE TO RESUME WORK BELOW GROUND FOR AT LEAST EIGHT WEEKS

SECTION III

DEVELOPMENTS IN CONNECTION WITH MINE SAFETY

The introduction of new safety regulations and the implementation of the Mines Safety and Health Commission's Recommendations on 1 January 1966, were dealt with in detail in the Third Report and in Comments in the accompanying Summary Report. The Fourth Report only mentioned the regulations that came into force in 1966.

The present report will only discuss the manner in which the Mines Safety and Health Commission's Recommendations and directives were applied. Annex II gives detailed account of the replies received, together with the position as at 1 January 1966 and 1 January 1968.

By and large, the 202 recommendations and directives on technical matters were well observed. They were covered by safety regulations, and where these did not exist, they were applied in practice.

The reasons why certain proposals are not applied in some countries are shown at the foot of the page; in most cases it is due to local conditions.

In 61 cases, the proposals were applied to better effect in 1966-1968.

145 proposals were made on the subject of human factors, 80 of which were approved by the Mines Safety and Health Commission in 1966 and are therefore included in the questionnaire for the first time. It should be added that these new proposals were also adequately observed, like the previous 65; among the latter the situation improved in 43 cases.

The situation can be better judged when it is pointed out that the Mines Safety and Health Commission's proposals, which that Commission described as "recommendations" and "directives" are without the legal force conferred on these terms by the Paris and Rome Treaties. It should also be noted that these proposals are far from being equal in importance, some only being quoted as an aide-mémoire and not calling for a reply. It can therefore be said that the Governments have substantially observed the Mines Safety and Health Commission's proposals.

PUBLICATIONS DEPARTMENT OF THE EUROPEAN COMMUNITIES

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